The Energy Outlook: Drivers, Projections, and Implications

for
“Energy: The New Normal?”
Aspen Institute, Aspen, CO

by
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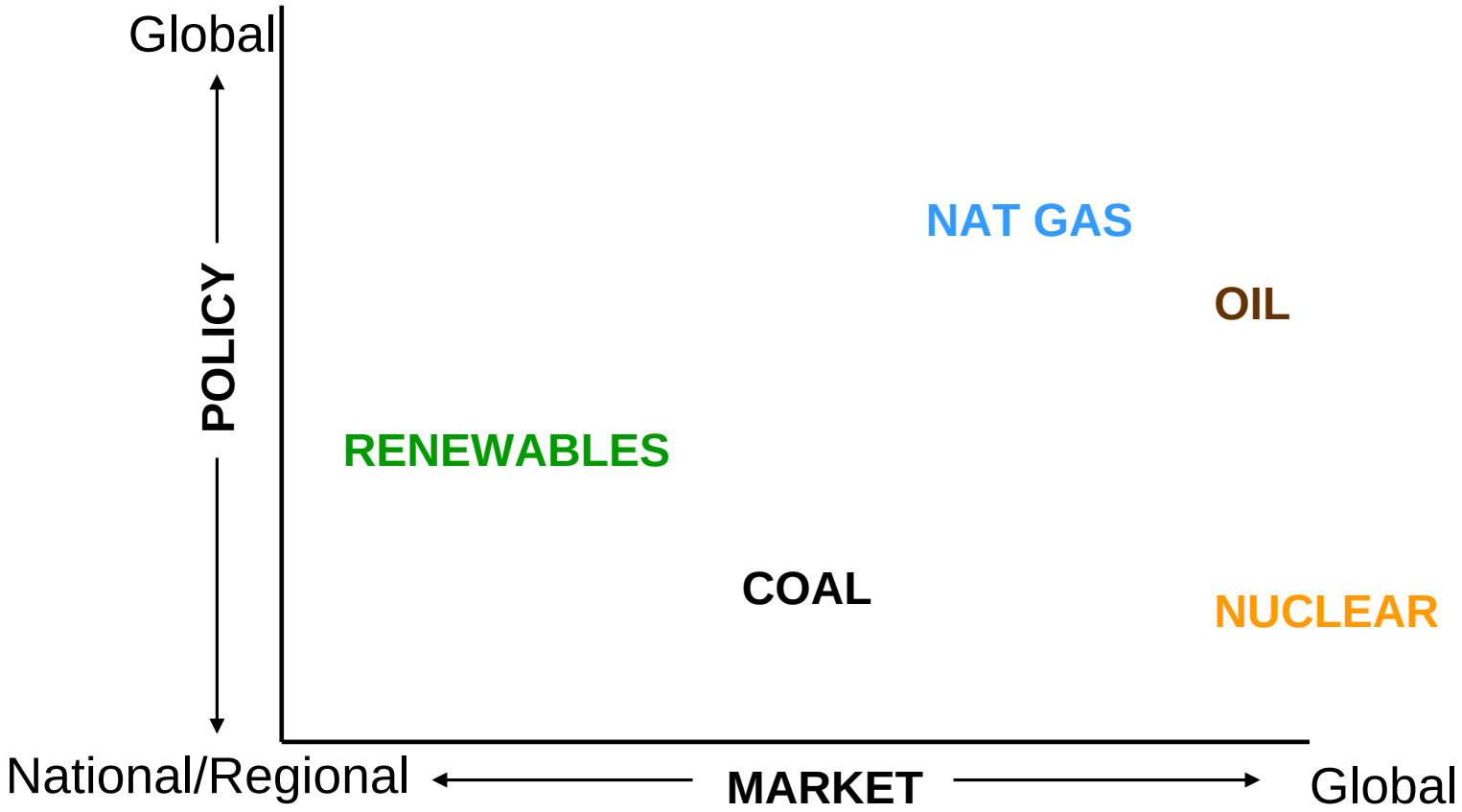
Outline

- Global Energy Outlook and underlying drivers
- U.S. Energy Outlook under current policies
- Synergies and Conflicts among Policy Objectives
- Potential impacts of a cap-and-trade program for U.S. GHG emissions constraints on the energy sector

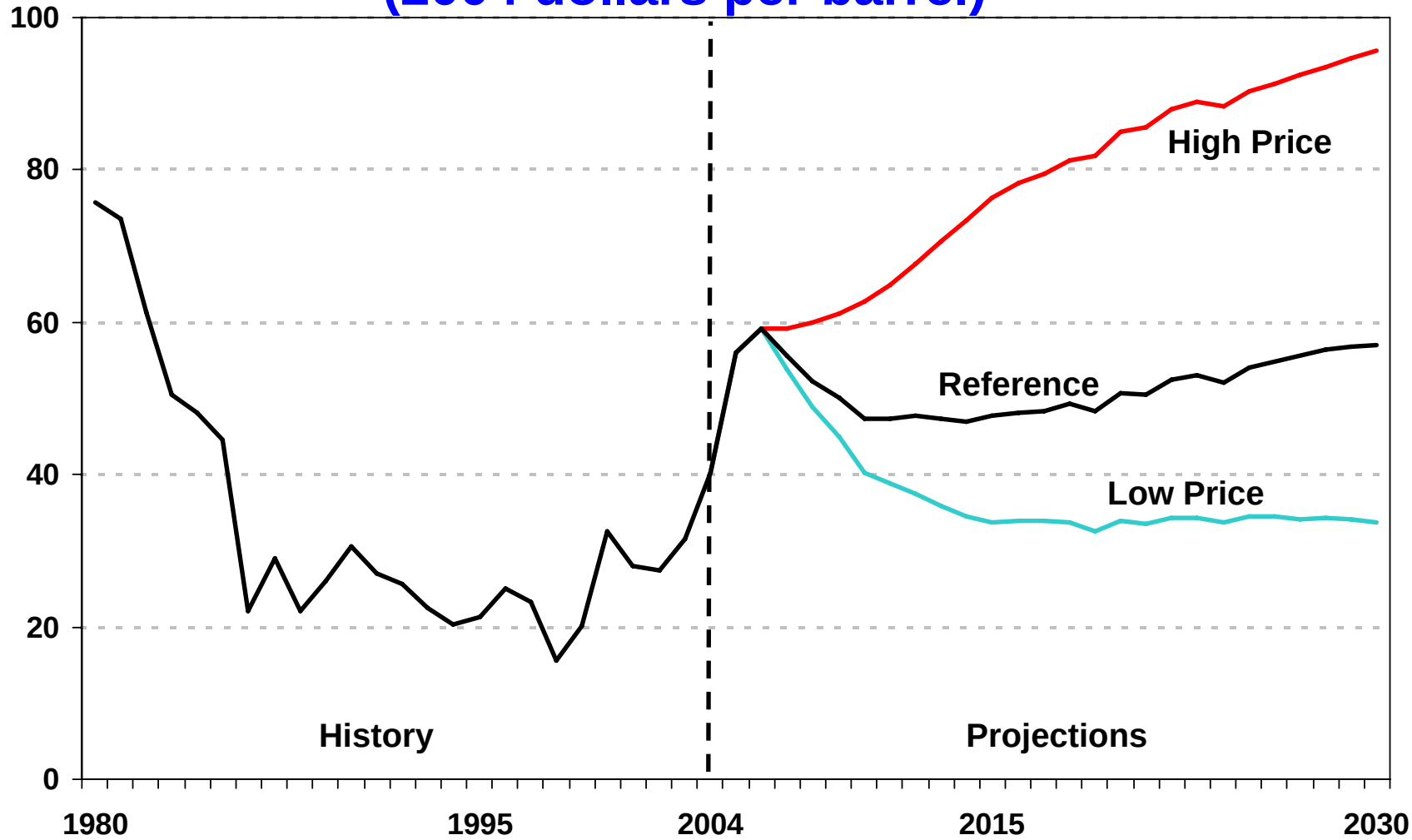
National/Regional and Global Influences Vary by Fuel



- Oil and nuclear are the most global fuels from a market perspective

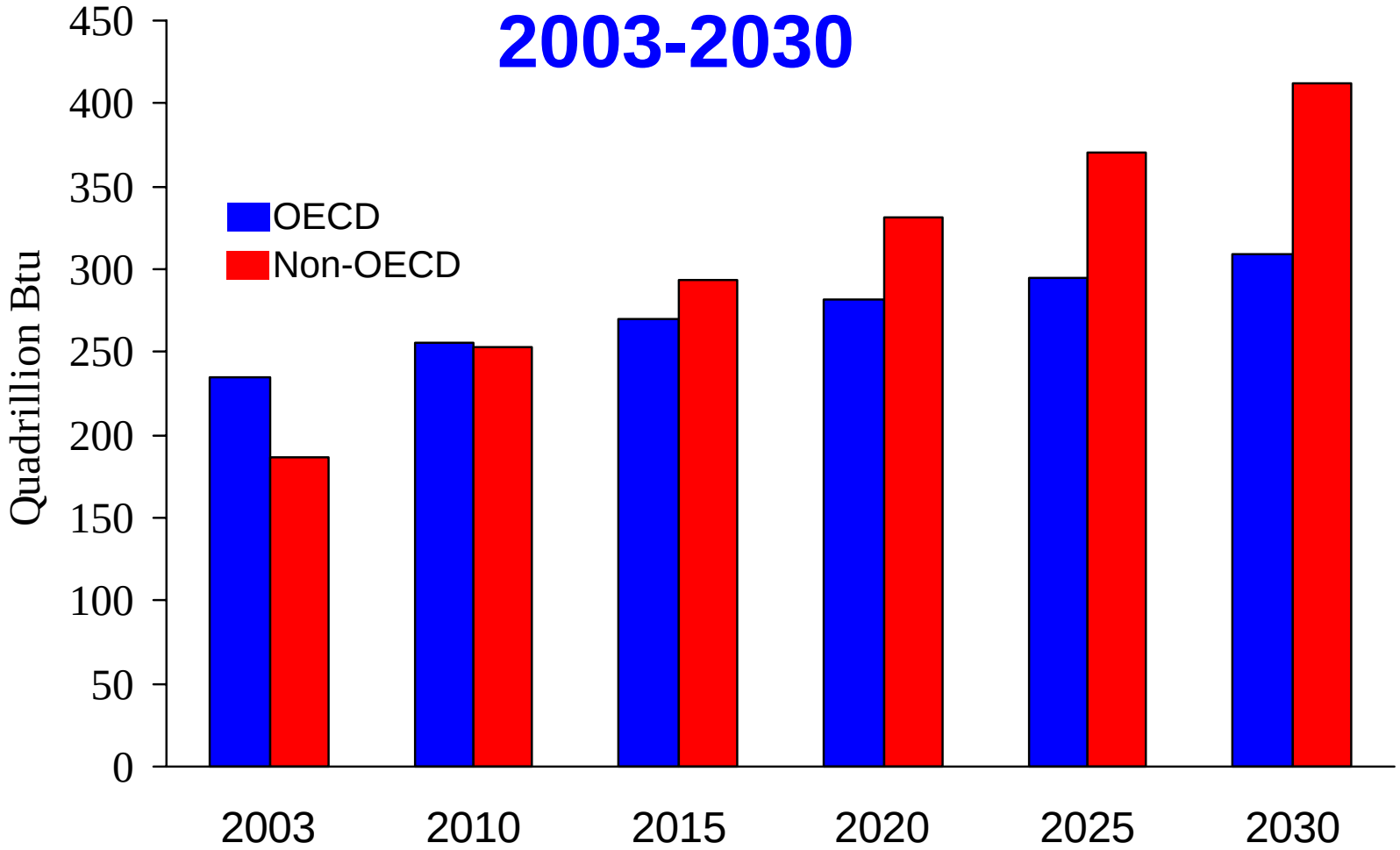
The Global Energy Outlook and Its Key Drivers

World Oil Prices in Three Cases, 1980-2030
(2004 dollars per barrel)



- The future path of oil prices is highly uncertain

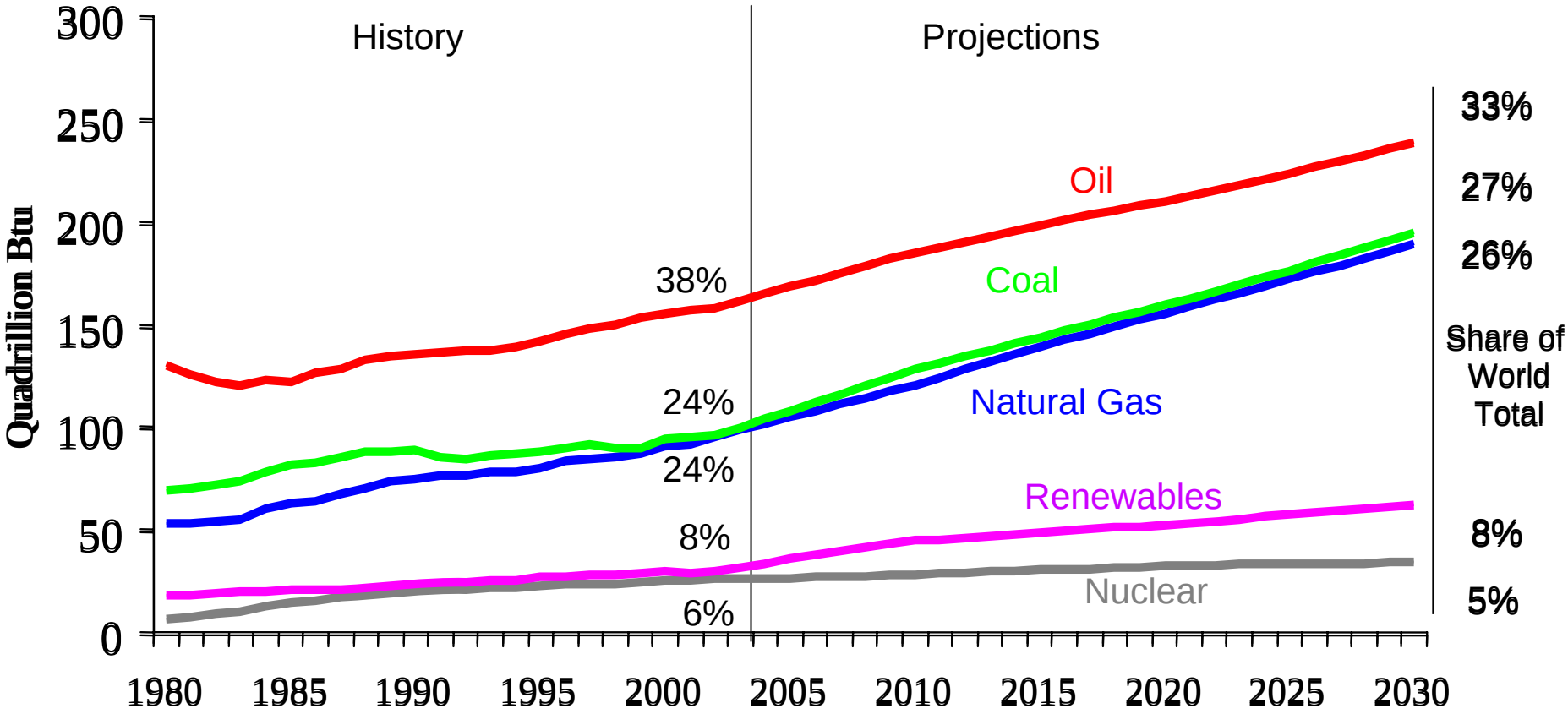
World Marketed Energy Use by Region, 2003-2030



- Most projected growth in energy use is outside of mature market economies

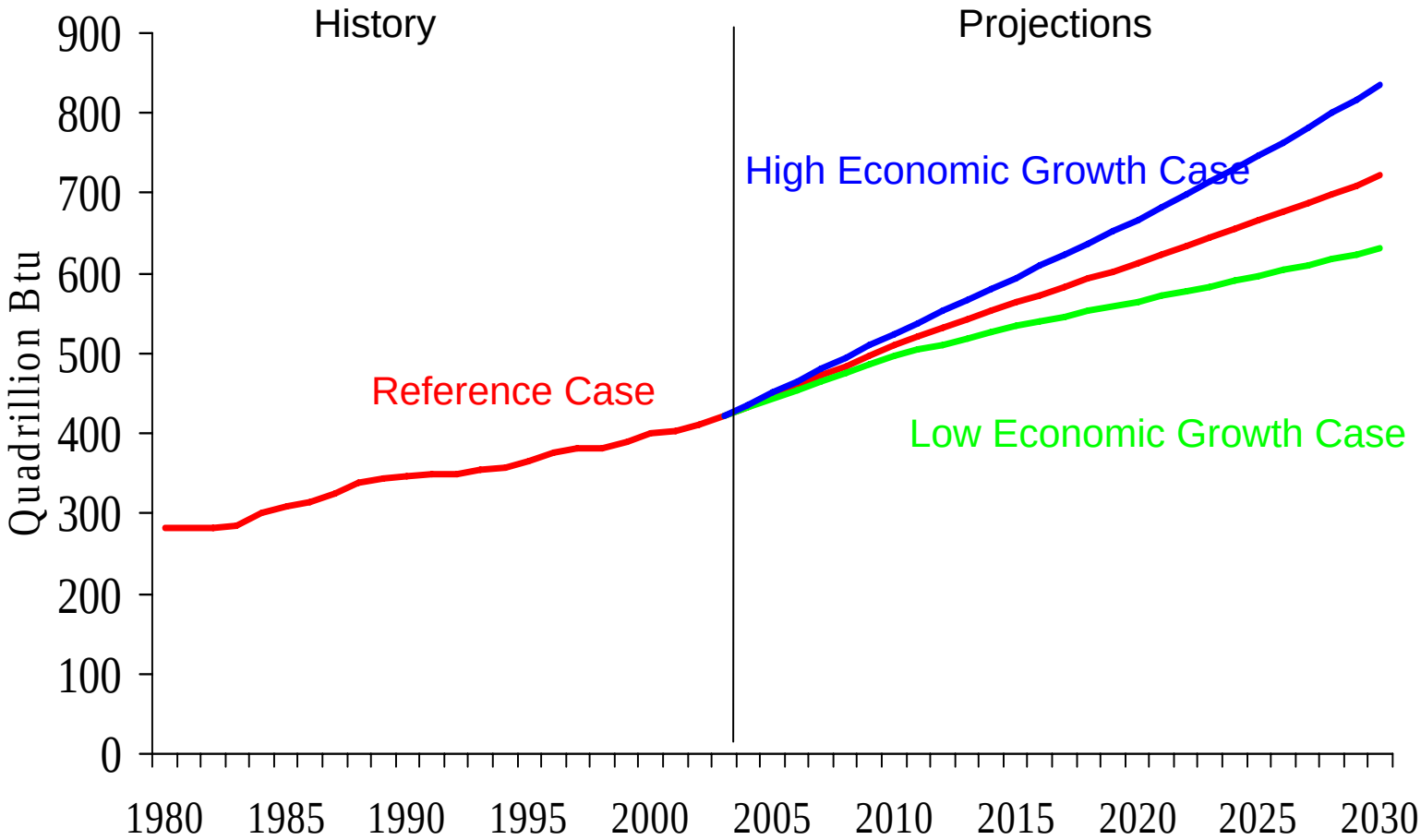
Source: EIA, International Energy Outlook 2006

World Marketed Energy Use by Fuel Type, 1980-2030



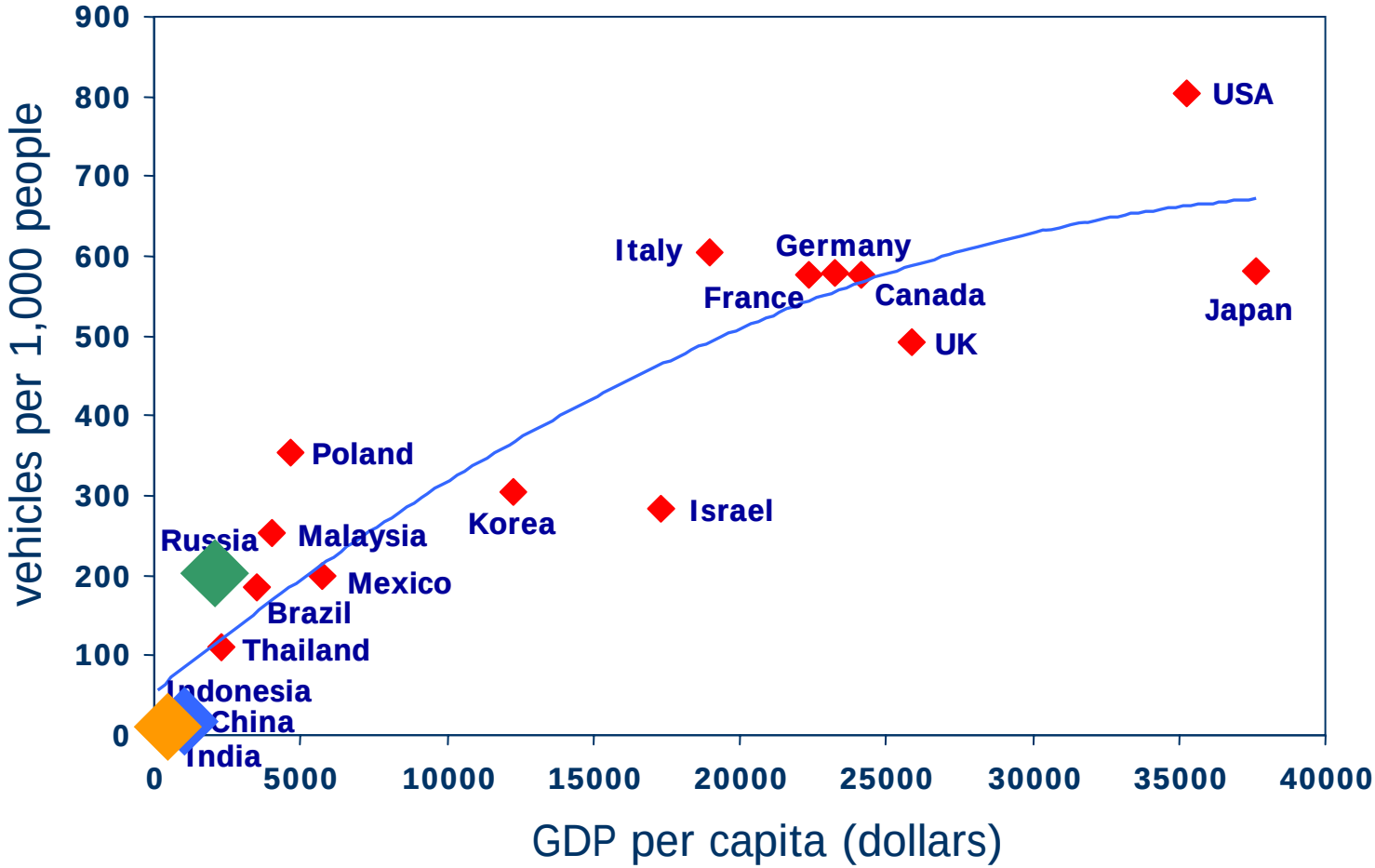
- Oil's share of total marketed energy use is projected to fall

World Marketed Energy Consumption in Three Economic Growth Cases, 1980-2030



- Economic growth is a key energy demand driver

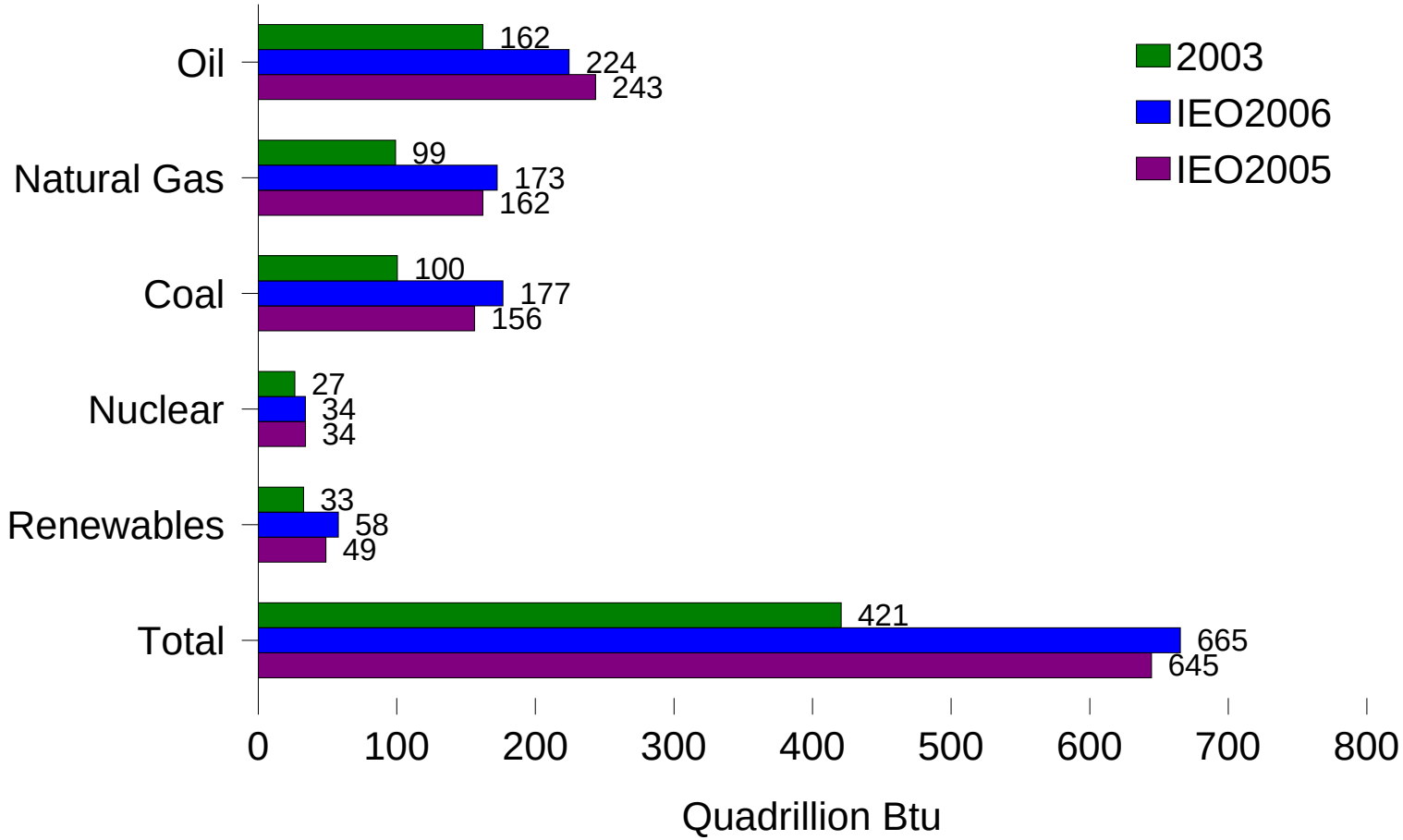
Vehicle Ownership, 2003



The potential for increased vehicle use in emerging markets is enormous

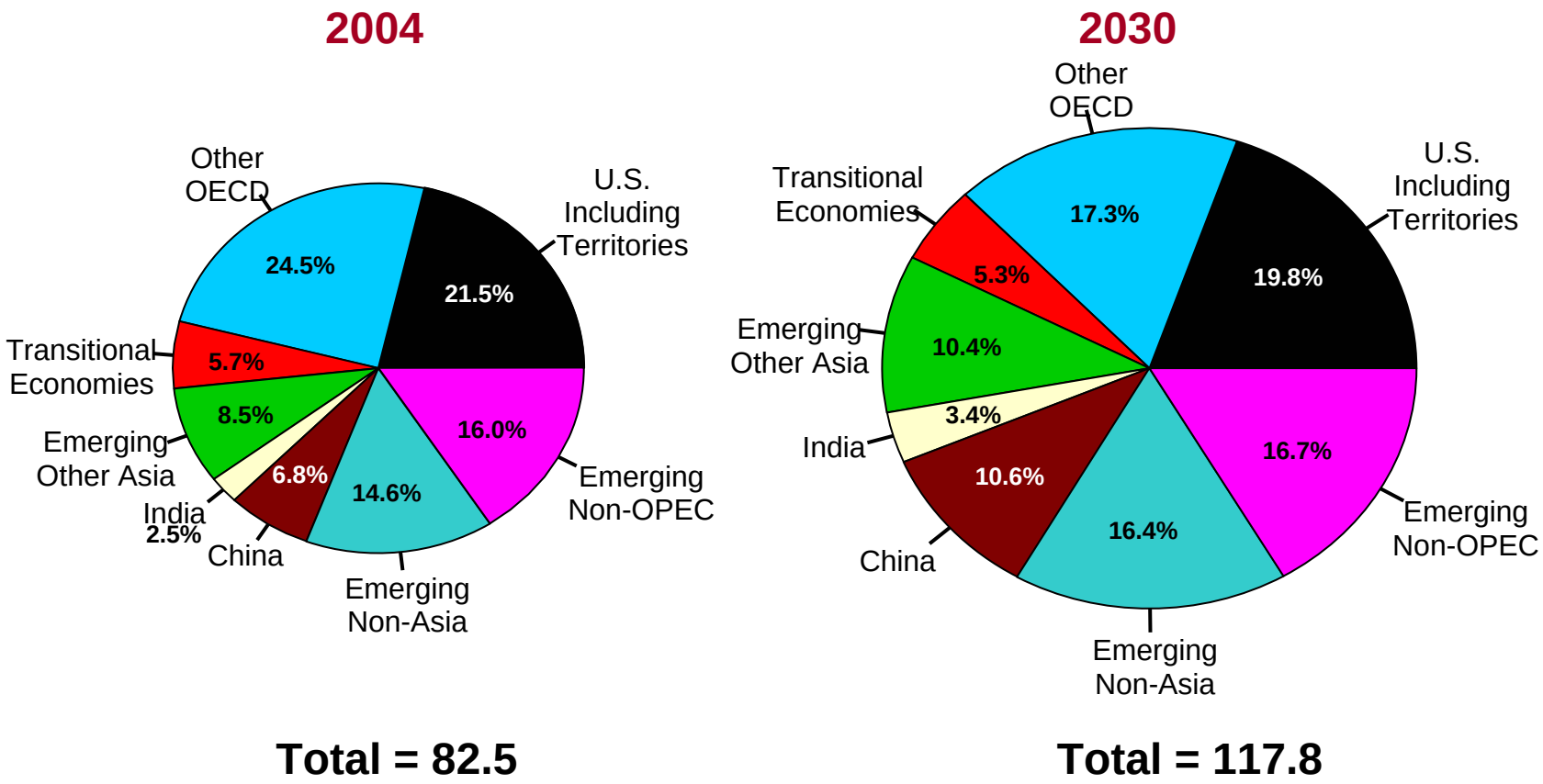
SOURCE: OECD/IEA (2006) ©

Comparison of 2025 Projections: IEO2006 vs. IEO2005



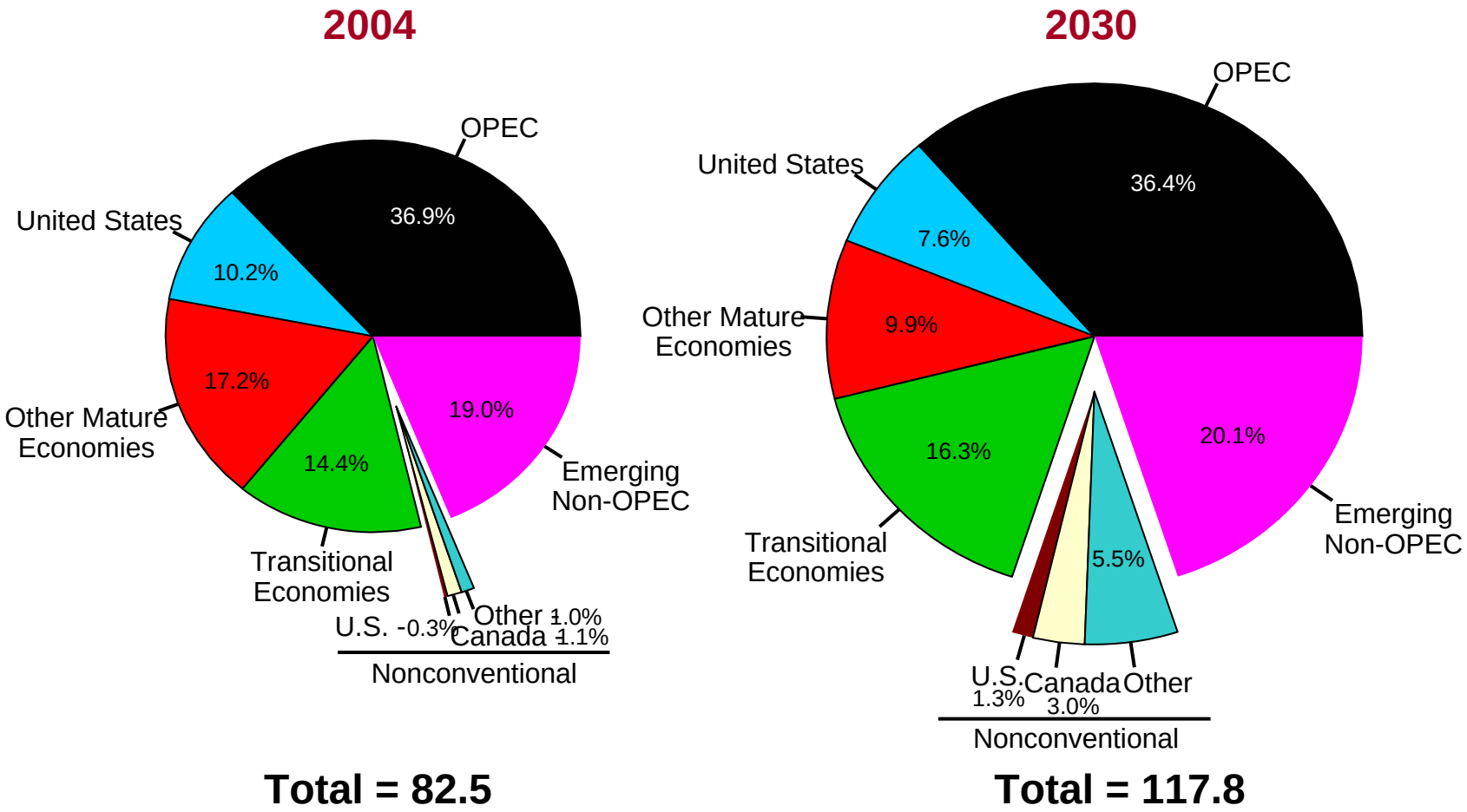
- Projected prices are another driver of the expected future energy mix

World Petroleum Consumption, 2004 and 2030 (million barrels per day)



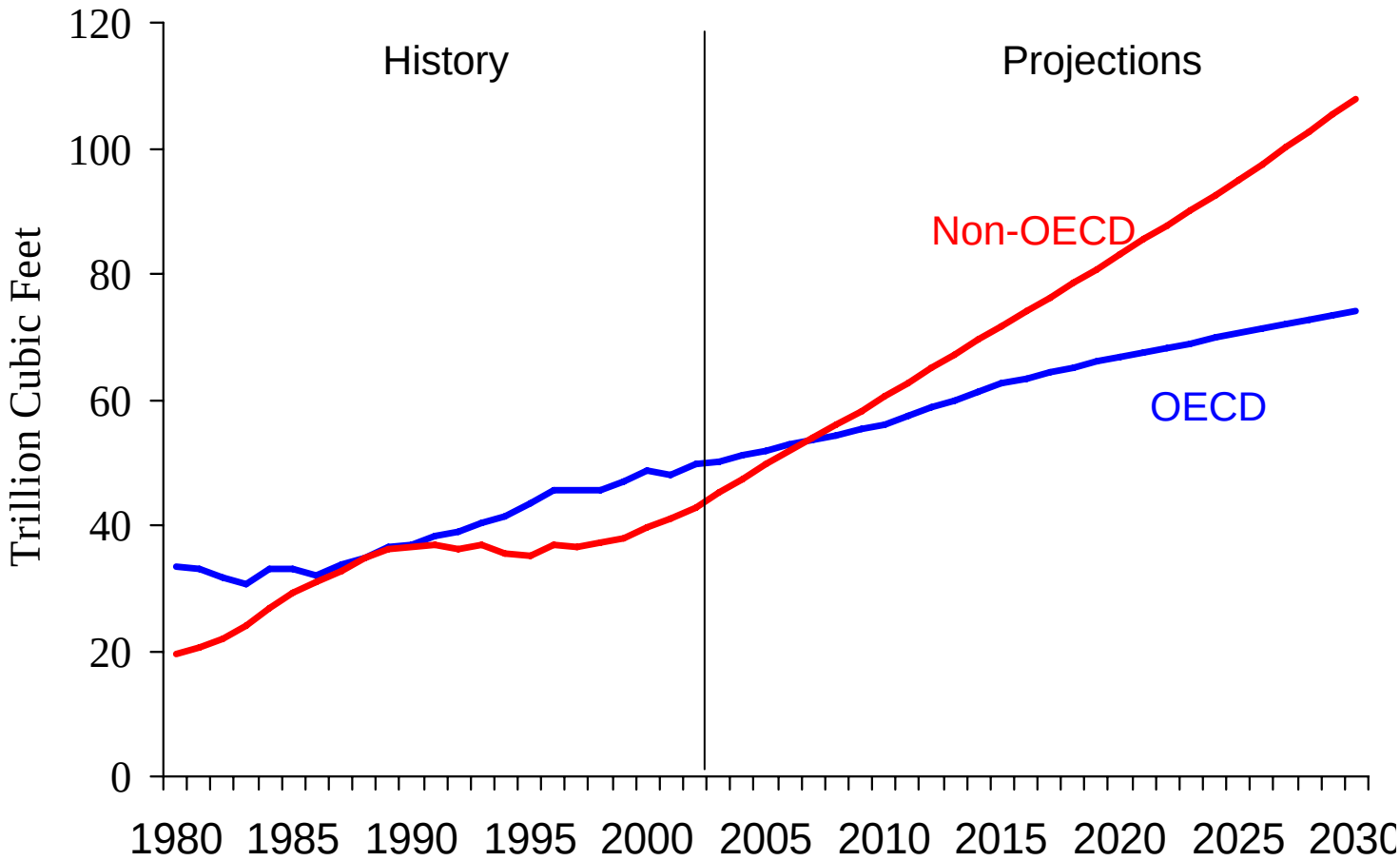
The U.S. share of total world oil use is projected to decline

World Petroleum Production, 2004 and 2030 (million barrels per day)



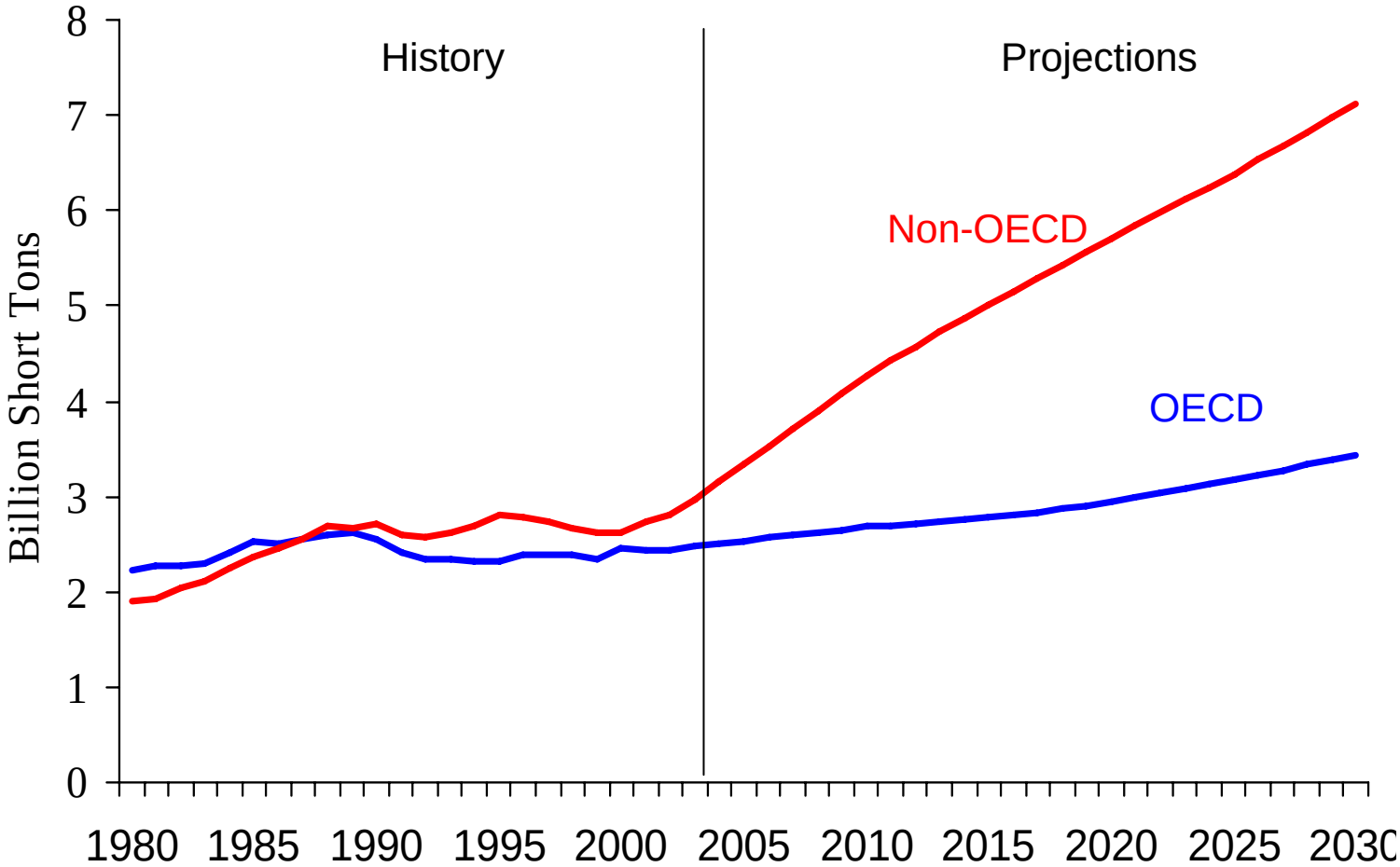
- Projected growth in conventional oil production is < 1 million barrels/ year

World Natural Gas Consumption, 1980-2030



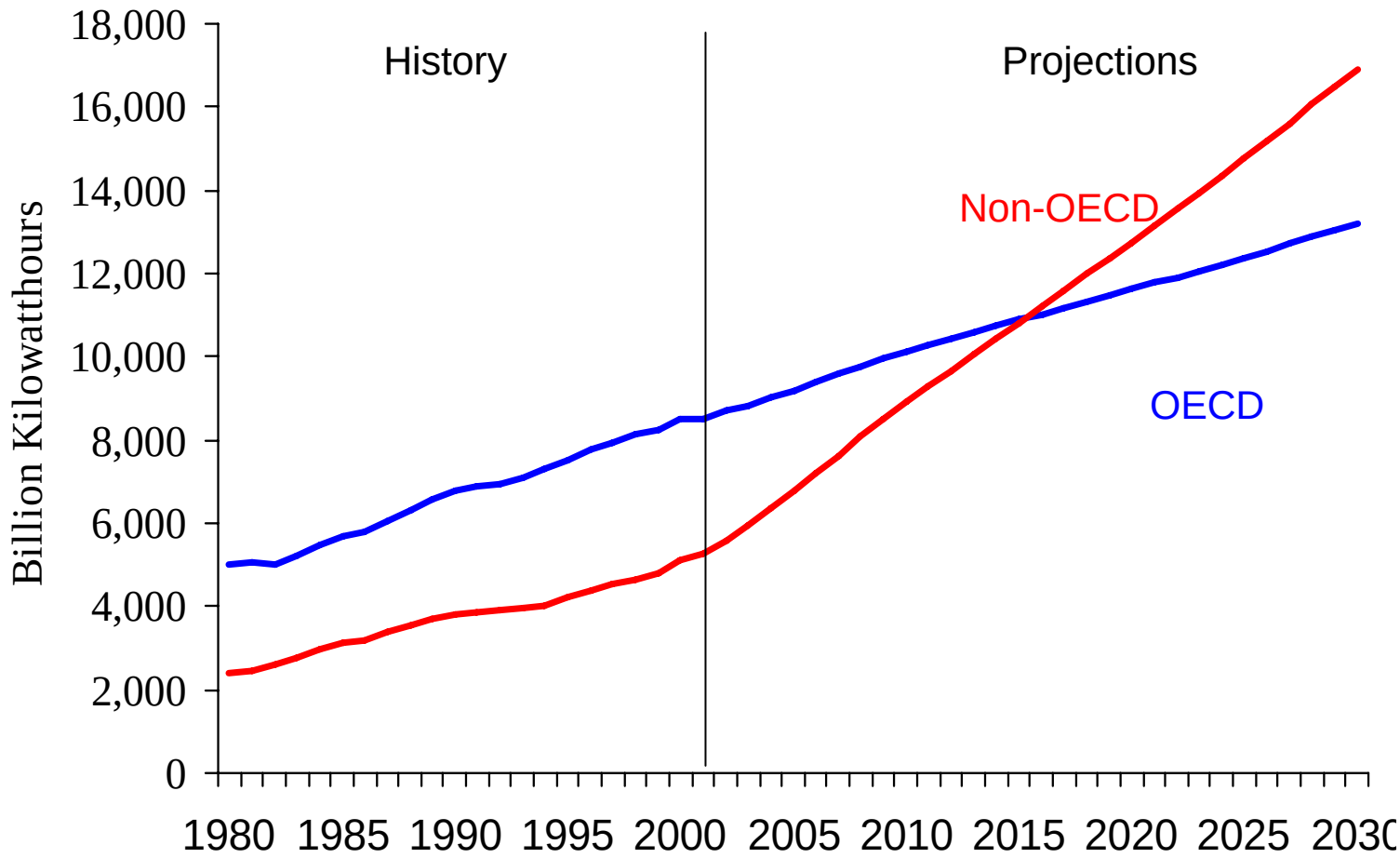
- Higher oil prices lead to faster growth in natural gas use

World Coal Consumption, 1980-2030



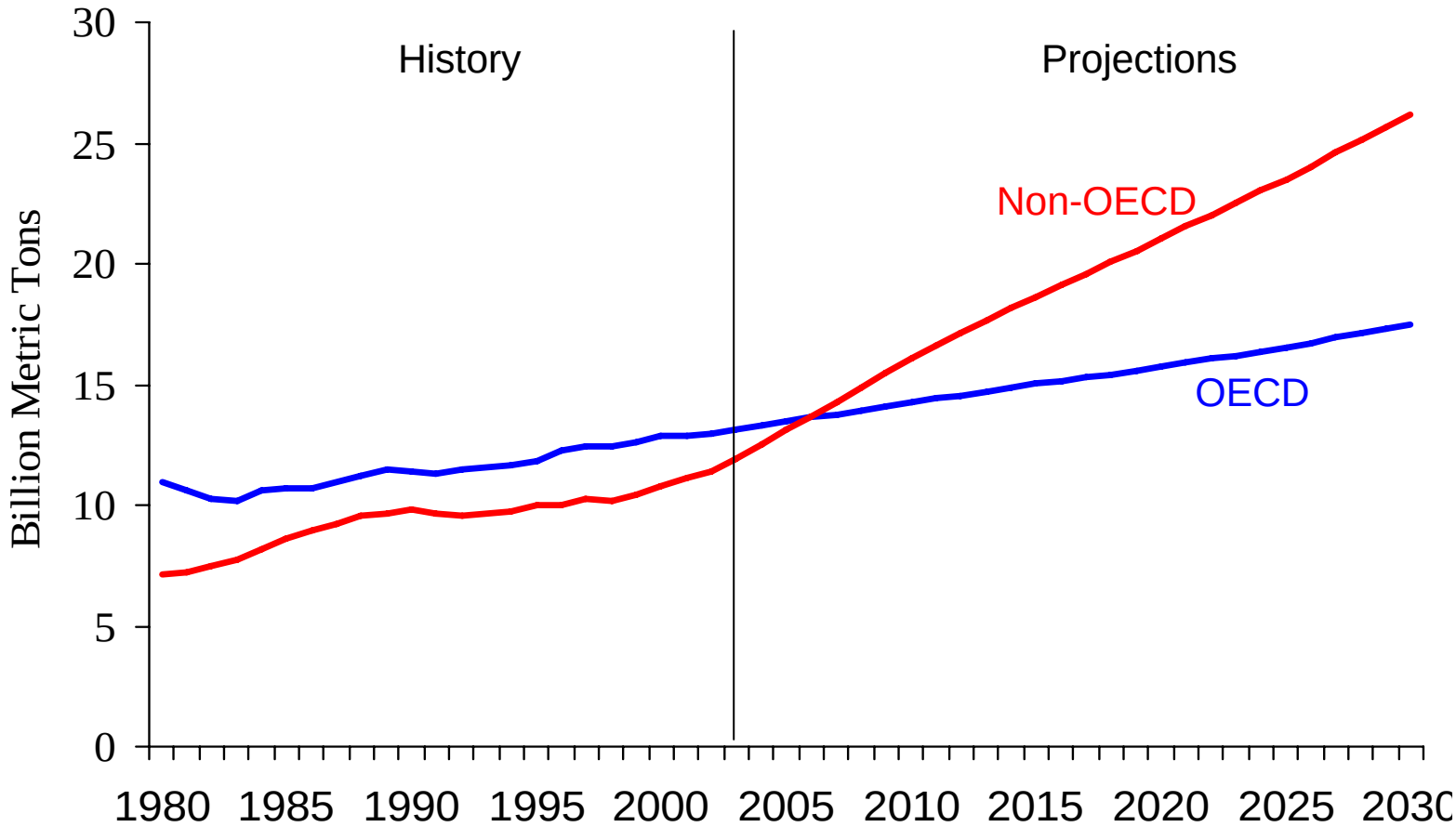
- China and India dominate projected growth in coal use

Net Electricity Consumption, 1980-2030



- Electricity use grows rapidly in both developed and developing countries

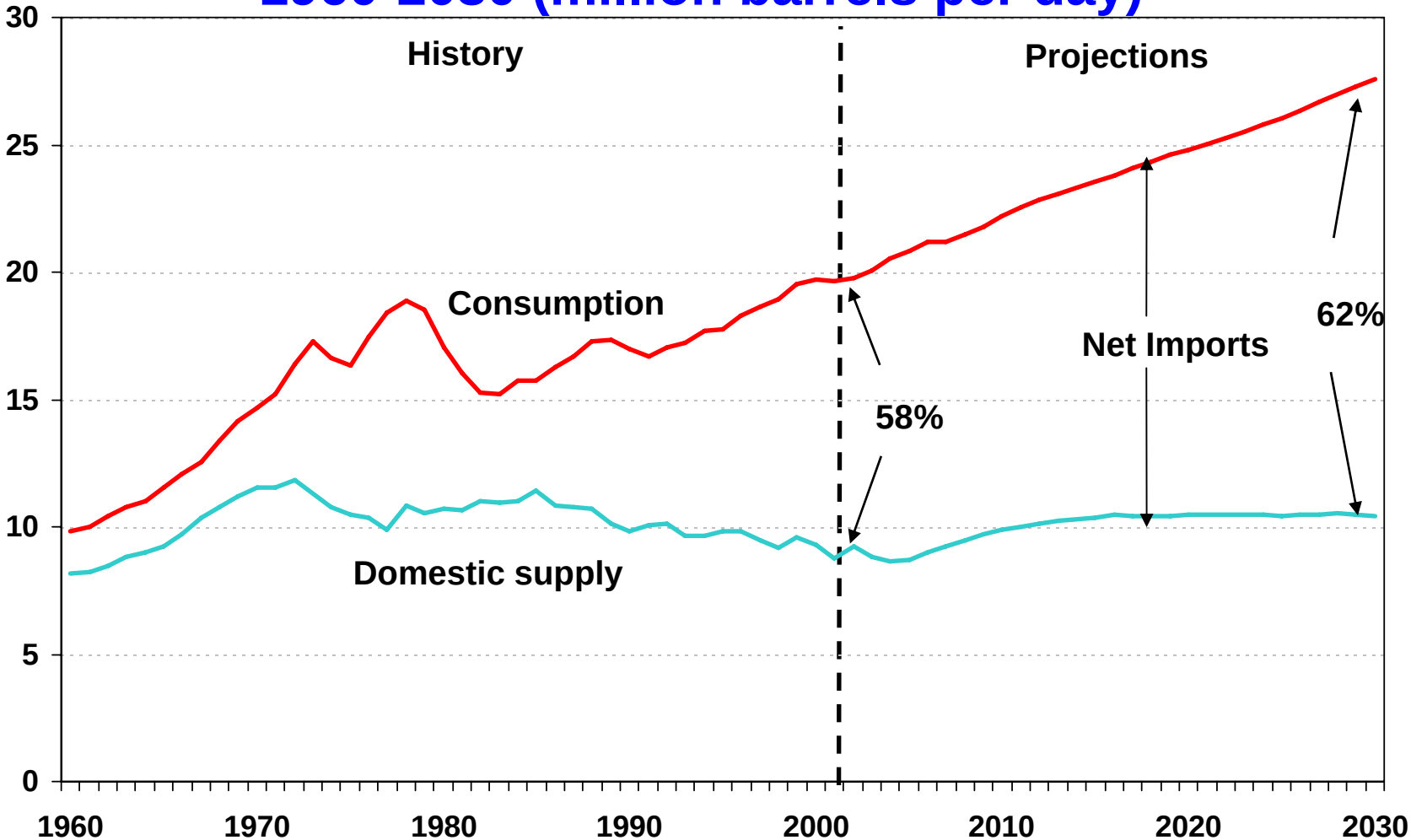
World Energy-Related Carbon Dioxide Emissions 1980-2030



- Projected CO2 emissions trends are driven by growth in fossil fuel use

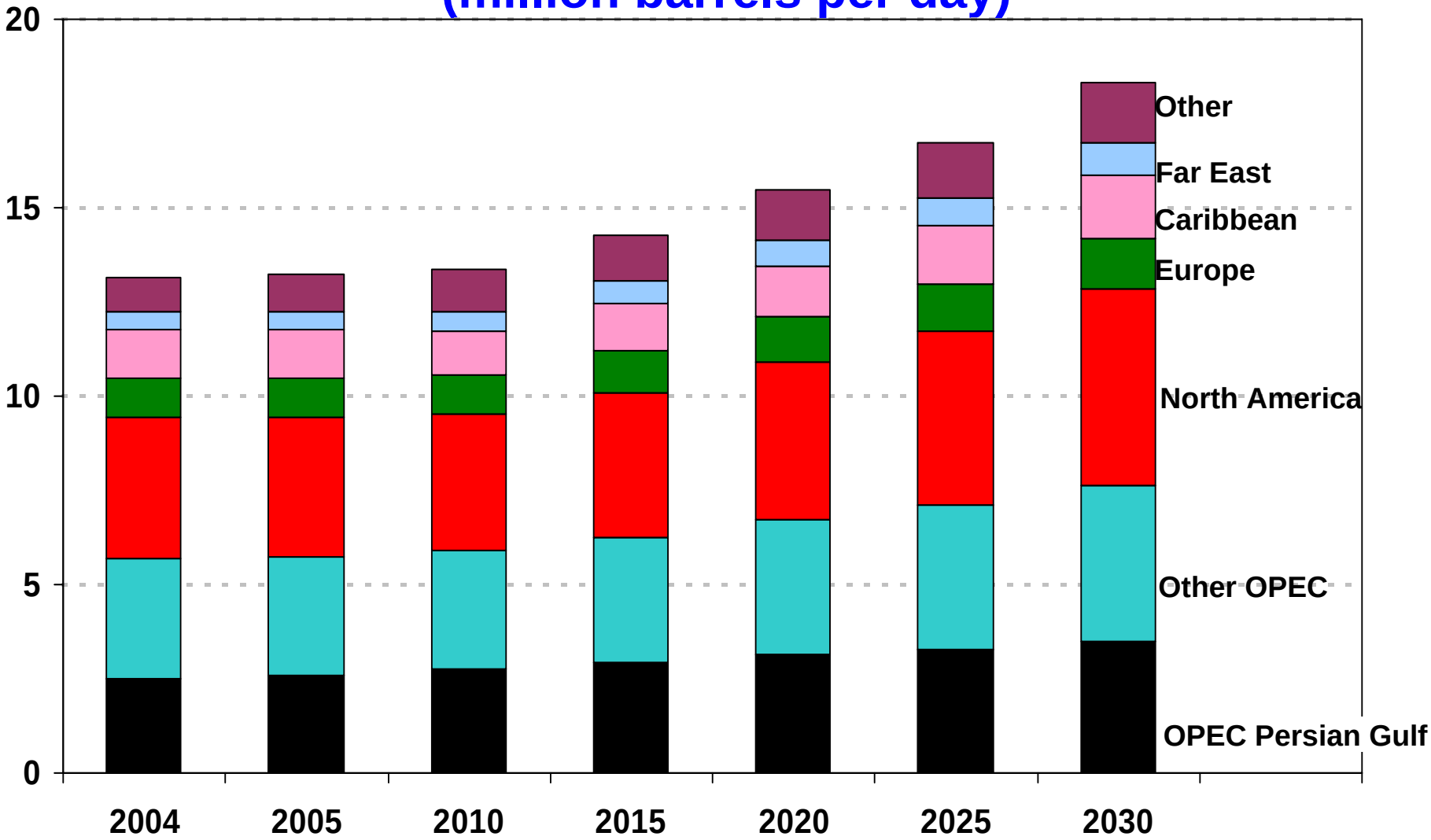
The U.S. Outlook

U.S. Petroleum Supply, Consumption, and Net Imports, 1960-2030 (million barrels per day)



- The import share in total U.S. oil use is projected to grow slowly

U.S. Gross Petroleum Imports by Source, 2004-2030 (million barrels per day)

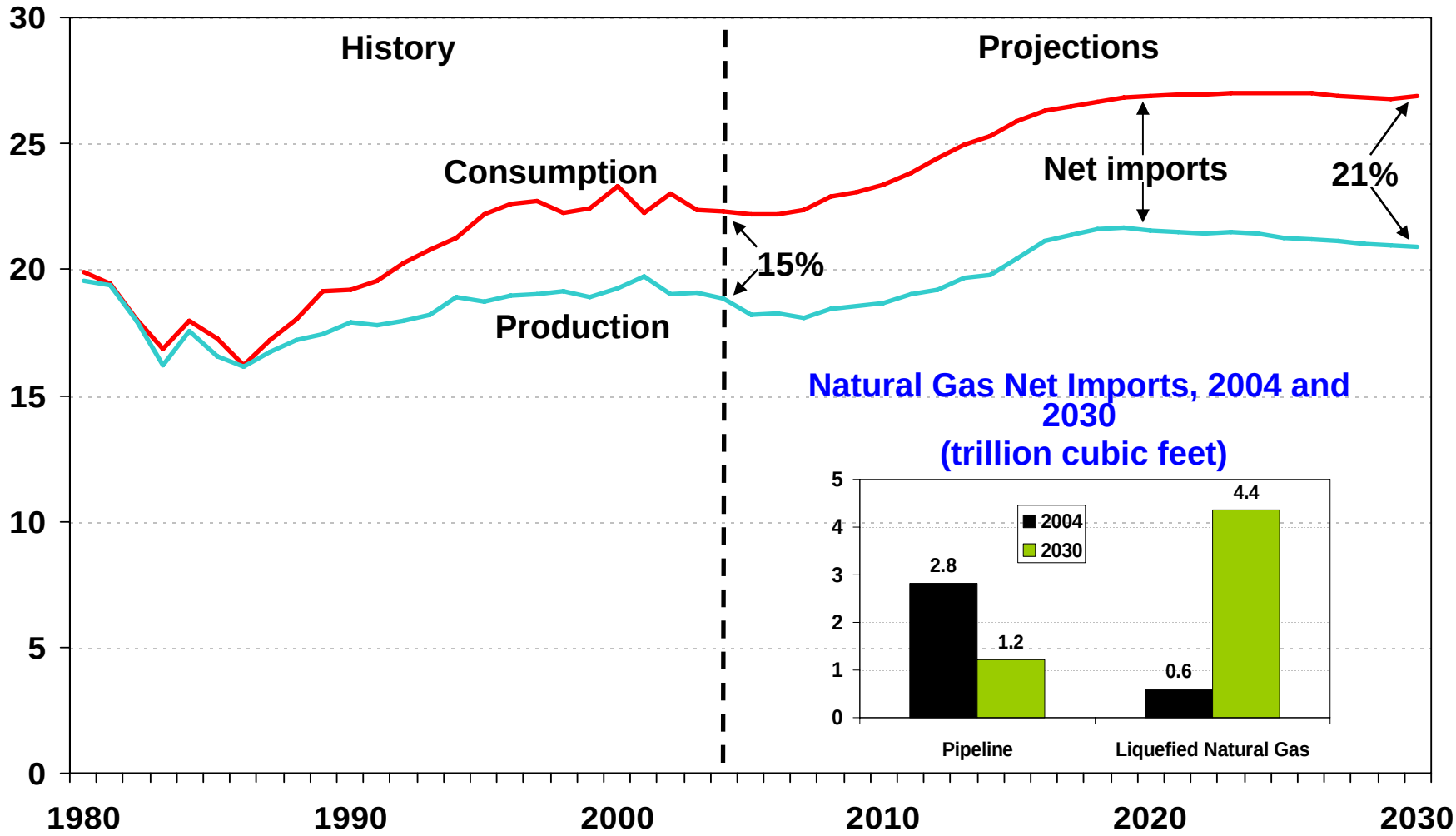


- Projected U.S. oil imports from the Middle East increase only slightly

Oil and U.S. Natural Gas Prices

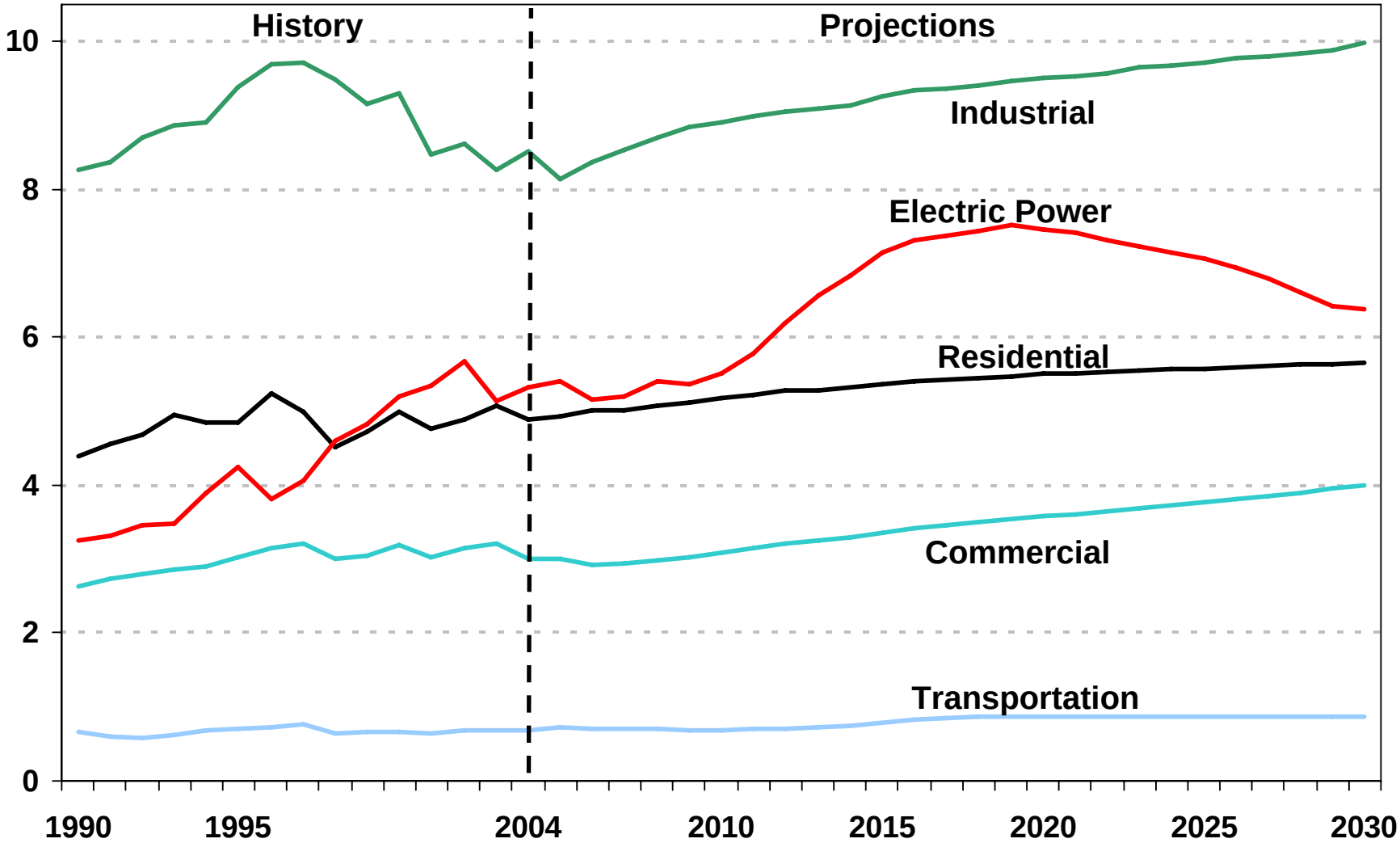
- **Oil prices are projected to remain higher than natural gas prices on an energy content basis through 2030.**
- **Although there are significant flows of LNG, U.S. natural gas prices are determined in the North American market.**
- **Three key interrelated questions:**
  - **Elasticity of global supply of stranded natural gas**
  - **Potential competition between LNG and GTL markets**
  - **Value of foreign stranded natural gas at the wellhead**

Natural Gas Production, Consumption, and Imports, 1980-2030 (trillion cubic feet)



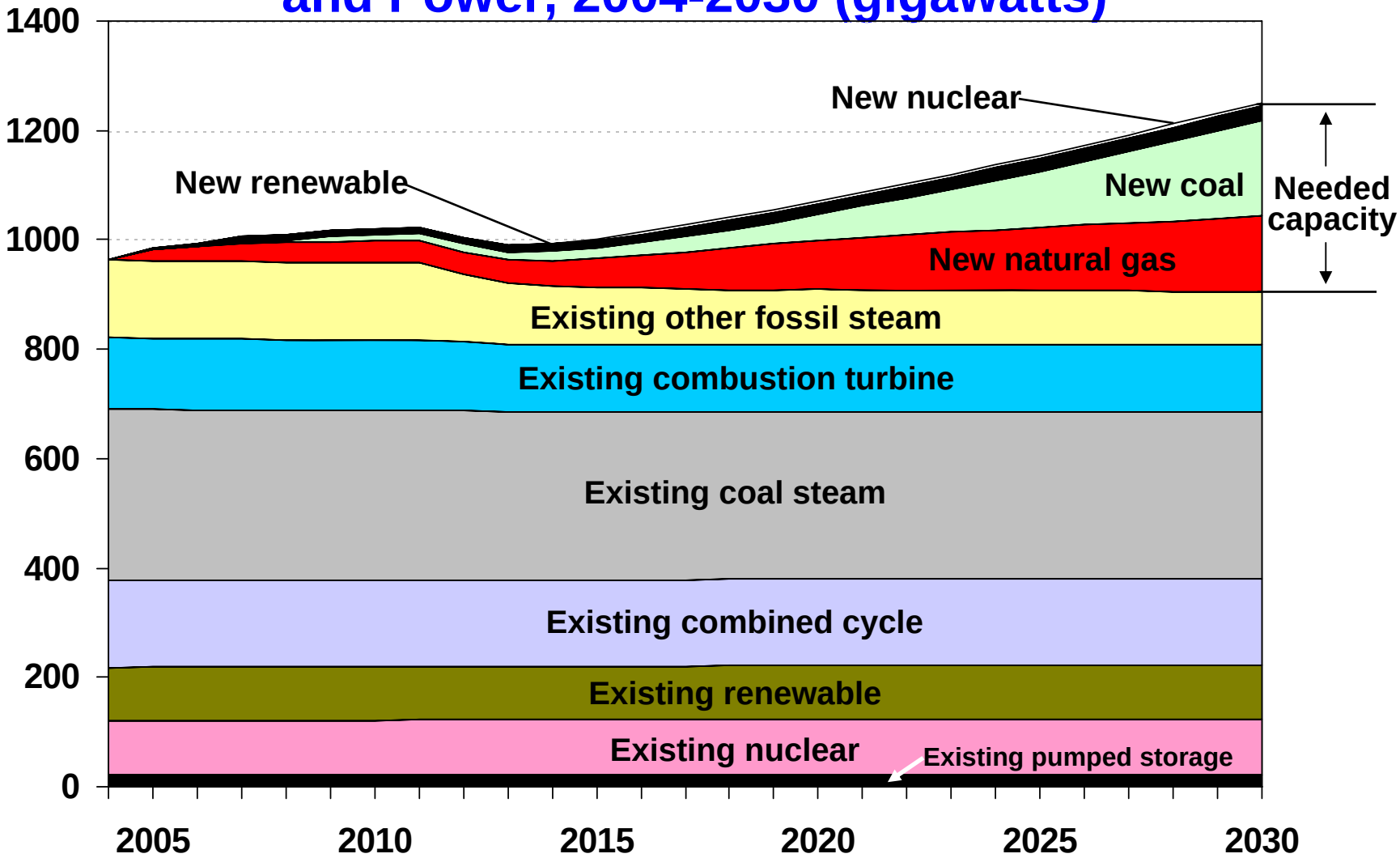
- Natural gas consumption flattens after 2020; import sources also change

U.S. Natural Gas Consumption by Sector, 1990-2030 (trillion cubic feet)



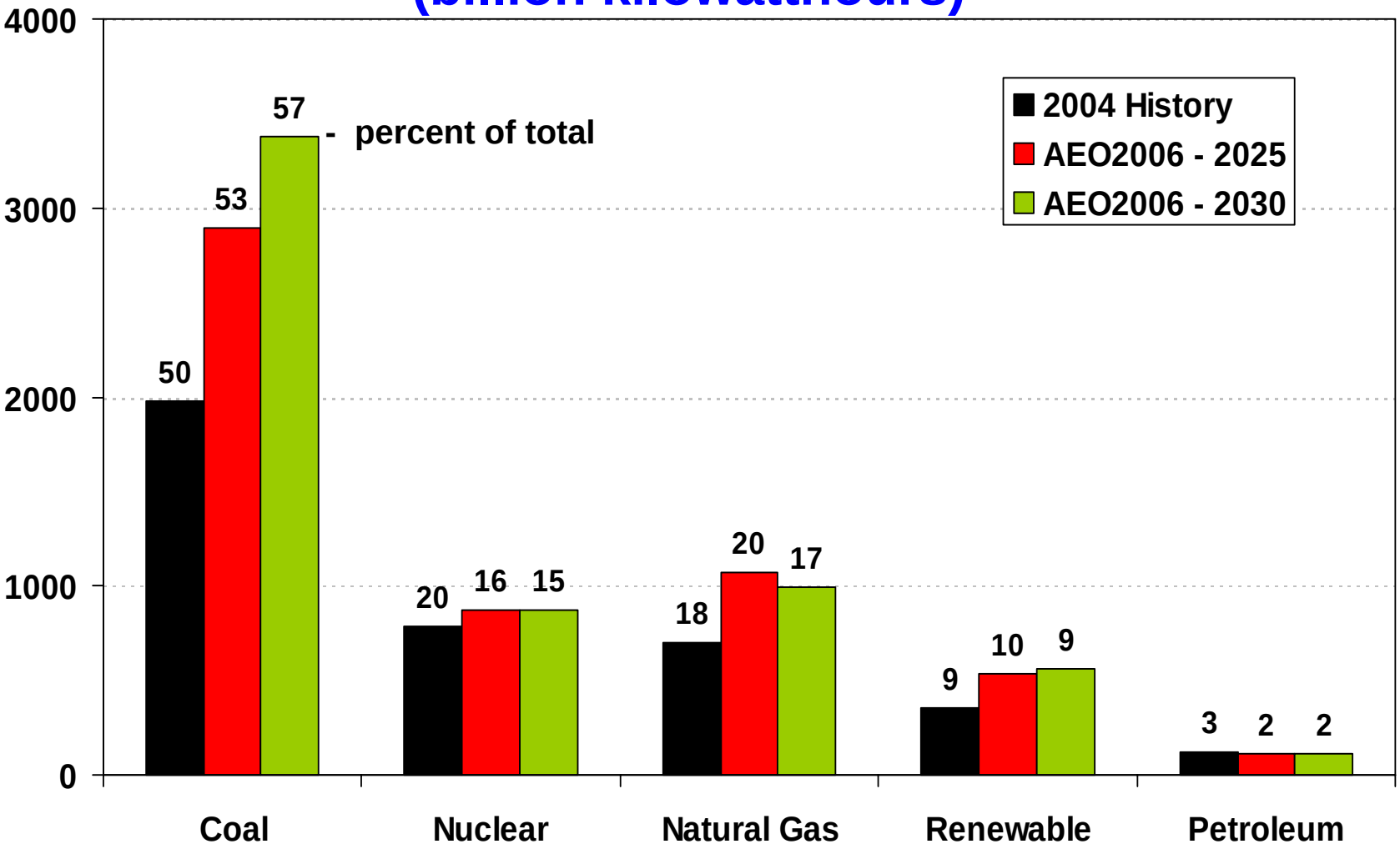
- Projected use of gas to generate electricity falls after 2020

Electricity Generating Capacity including Combined Heat and Power, 2004-2030 (gigawatts)



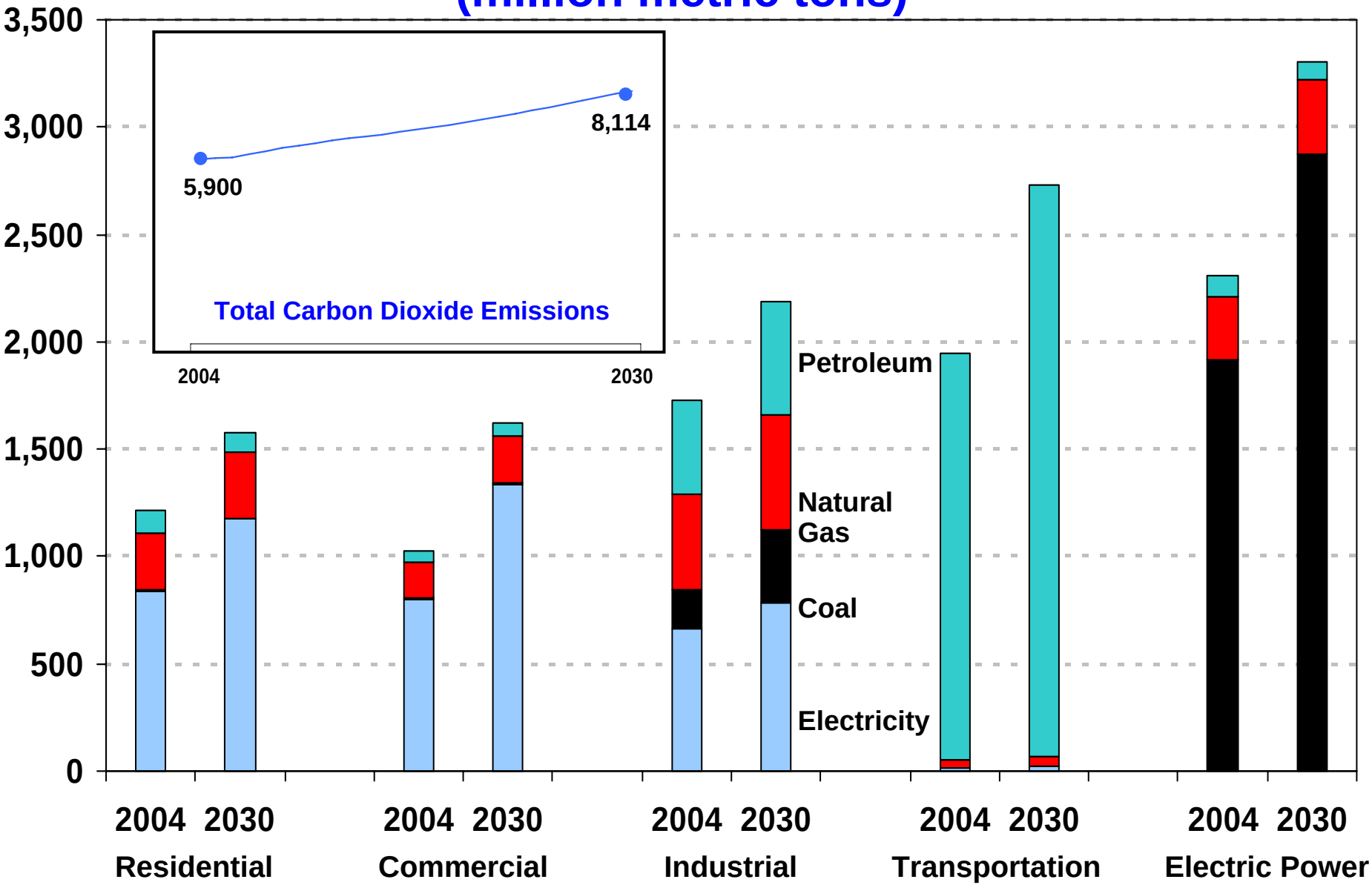
- Nearly all existing capacity is projected to still be used in 2030

Electricity Generation by Fuel, 2004, 2025, and 2030 (billion kilowatthours)



- The share and absolute level of coal-fired generation increases over time

Carbon Dioxide Emissions by Sector and Fuel, 2004 and 2030 (million metric tons)



Synergies and Conflicts Among Policies and Impacts of Potential Policies to limit US GHG Emissions

Interrelationships Between Oil Demand, Energy Security and Greenhouse Gas (GHG) Reduction

- Would U.S. energy security improve or worsen in a world where unstable exporters provided a larger share of a smaller world demand?
- What is the relative weight placed on reducing oil imports compared to reducing greenhouse gas emissions?
- What are we willing to do if things get really "bad?" – *ex ante* and *ex post* opportunity sets may differ.
  - Fact: 9-11 and Pearl Harbor
  - Fiction: Independence Day and Dr. Strangelove

Energy Security and GHG Emission Reduction: some synergies (S), some conflicts (C)

- **(S) Improved vehicle efficiency: lowers GHG emissions and oil demand/imports (=more energy security?)**
- **(S/C) Biomass: should it back out coal used in electricity generation or oil used in transport fuels?**
- **(C) Coal to liquids: reduces oil import dependence, but not helpful on GHGs**
- **(S/C) CO2 sequestration requirements: helpful on GHGs, hurts coal, but can reduce oil imports via enhanced production from aging fields.**

Policy Changes Could Significantly Affect the Outlook for Electricity Markets

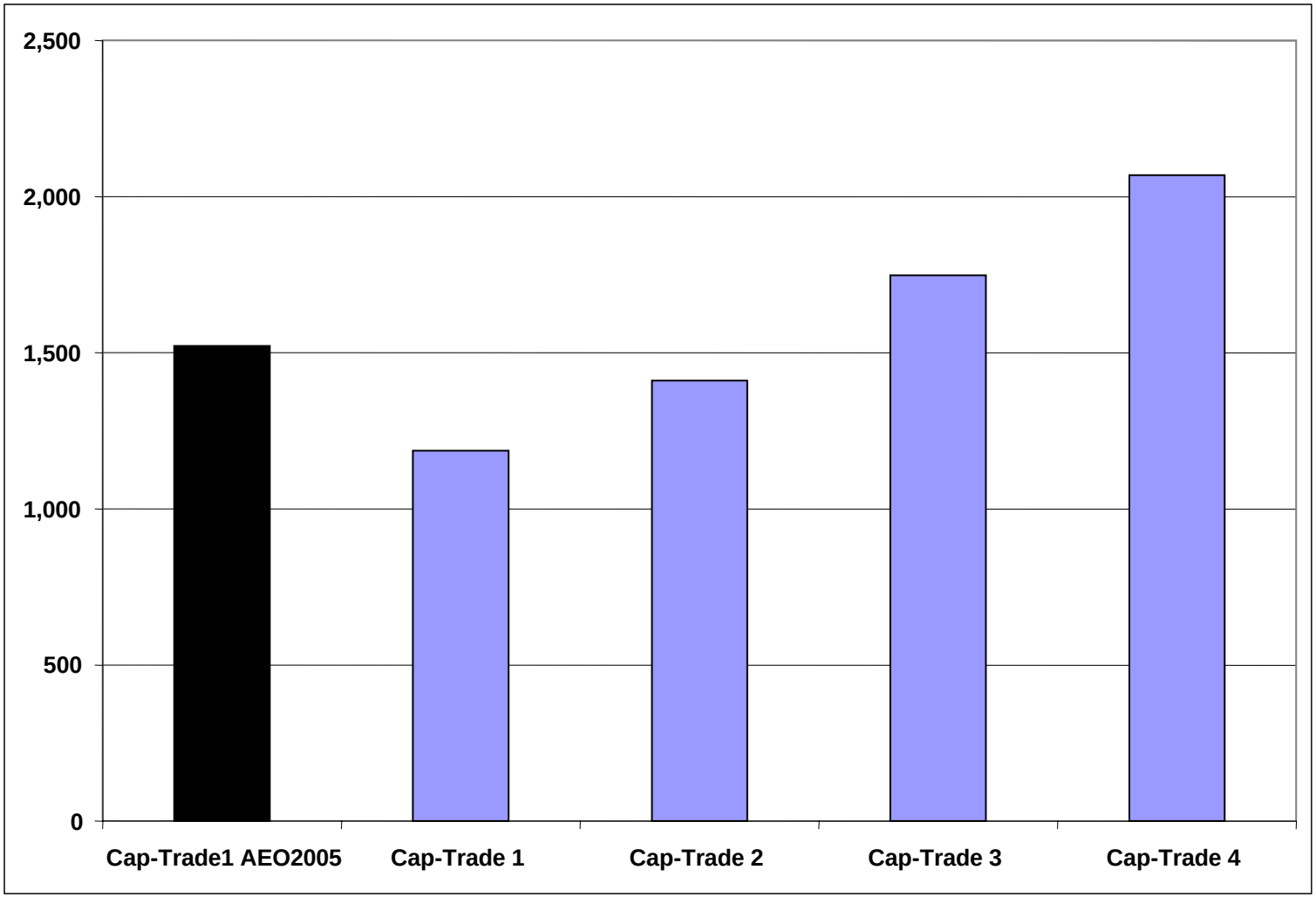
- As previously noted, EIA Reference Case projections are generally based on existing laws and policies.
- In recent reports, EIA has examined the energy implications of alternative cap and trade programs for greenhouse gas (GHG) emissions.
- The electricity sector, particularly projected coal use, was most significantly affected.

GHG Cap & Trade Analysis Cases

Case Name	GHG Intensity Reduction Goal (percent per year)		Safety Valve Price (2004 dollars per metric ton CO_2 equivalent)		Other
	2010-2019	2020-2030	2010	2030	
Cap-Trade 1	2.4	2.8	$ 6.16	$ 9.86	Greenhouse gas cap-and-trade system with safety valve.
Cap-Trade 2	2.6	3.0	$ 8.83	$14.13	
Cap-Trade 3	2.8	3.5	$22.09	$35.34	
Cap-Trade 4	3.0	4.0	$30.92	$49.47	
Cap-Trade 3 Low Other	2.8	3.5	$22.09	$35.34	Cap-Trade 3 with 50 percent reduction in other GHG abatement supply.
Cap-Trade 3 Low Safety	2.8	3.5	$ 8.83	$14.13	Cap-Trade 3 with lower assumed safety valves.
Cap-Trade 3 High Tech	2.8	3.5	$22.09	$35.34	Cap-Trade 3 with more optimistic technology assumptions.

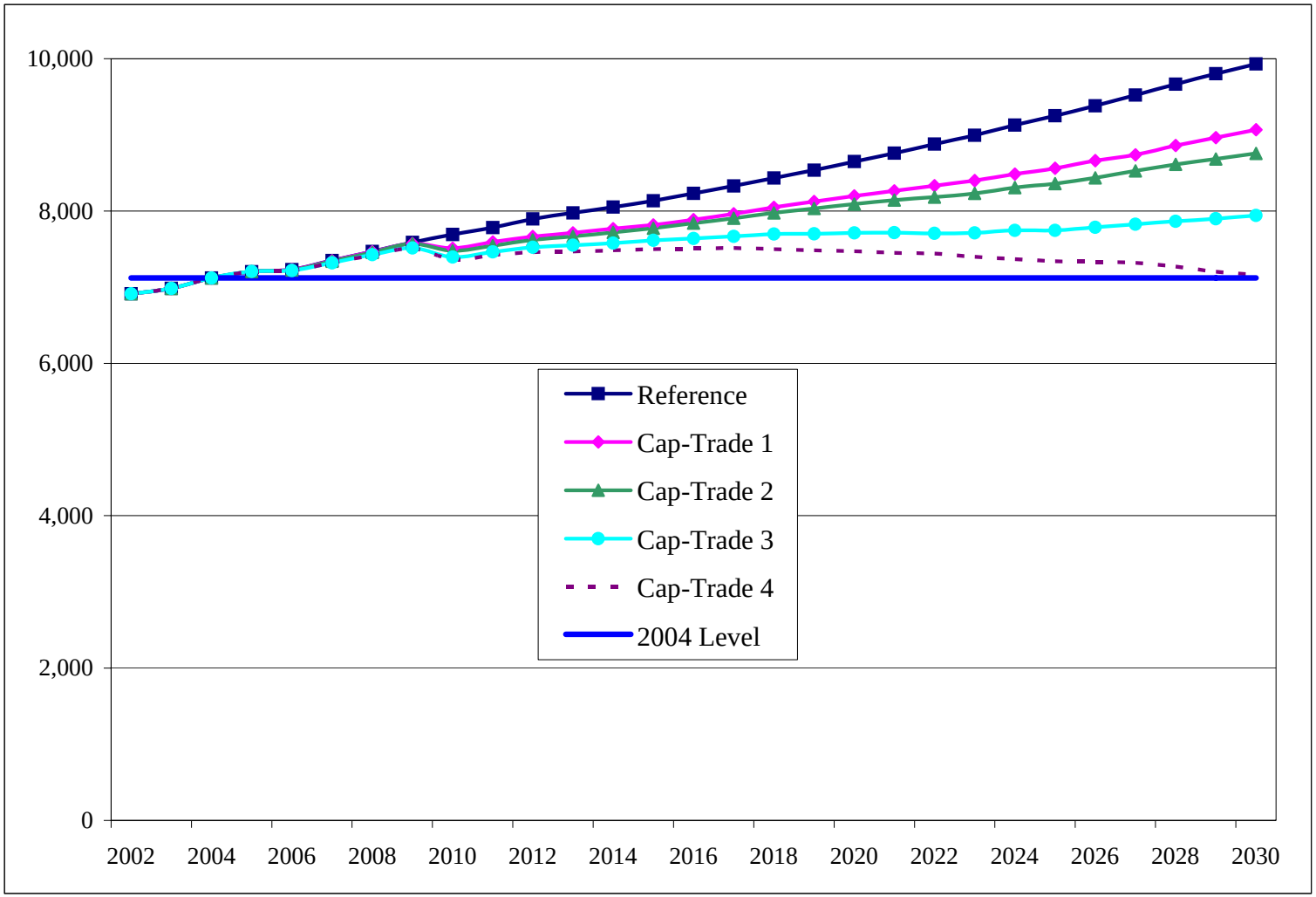
- A \$25/ton CO_2 permit price raises gasoline prices by about 23 cents/gallon.

Targeted Reduction in GHG Emissions in 2025
(Million Metric Tons Carbon Dioxide Equivalent)



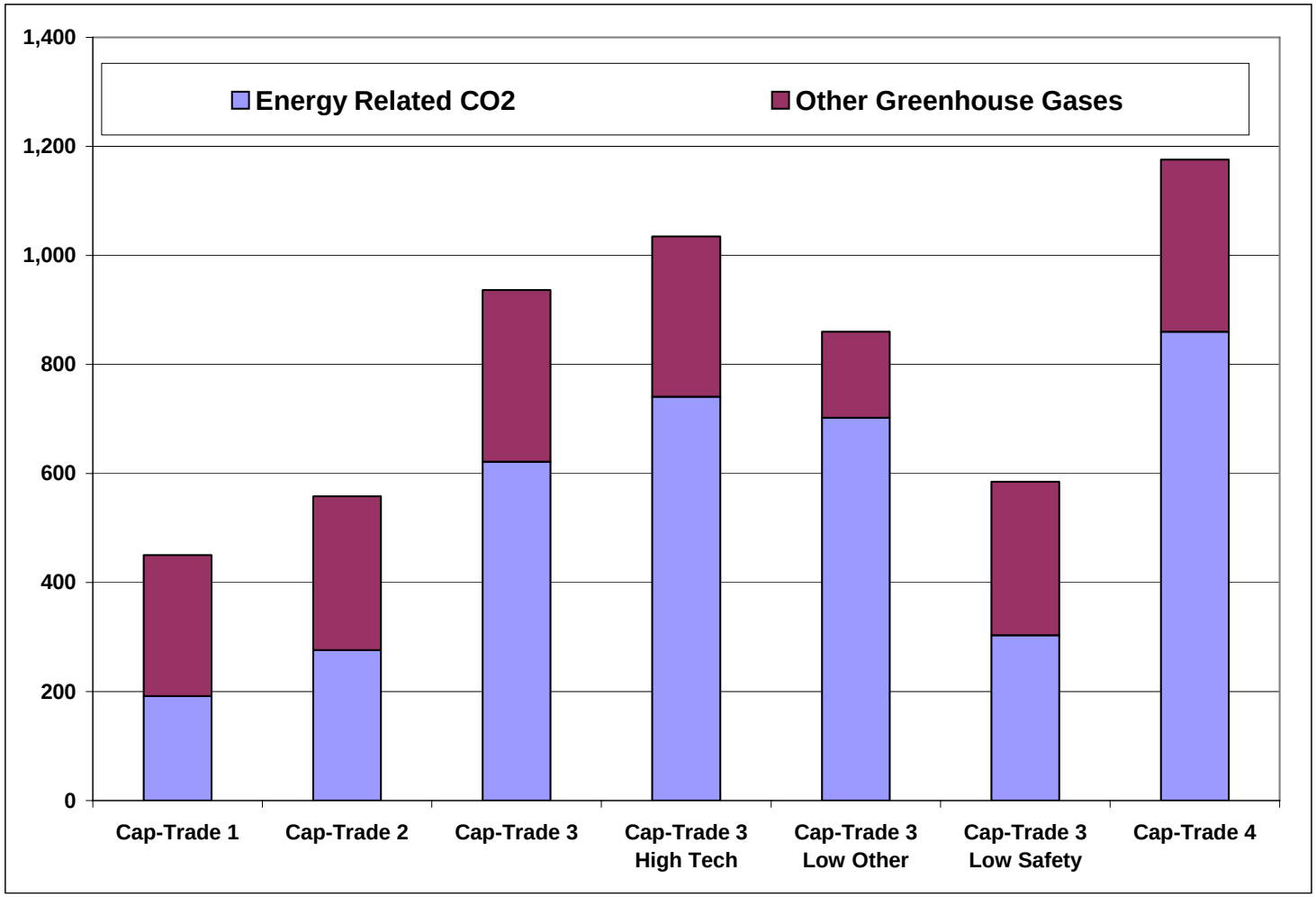
- Higher projected energy prices have reduced projected U.S. CO_2 emissions

Total GHG Emissions in Alternative Cases
(million metric tons CO_2 equivalent)



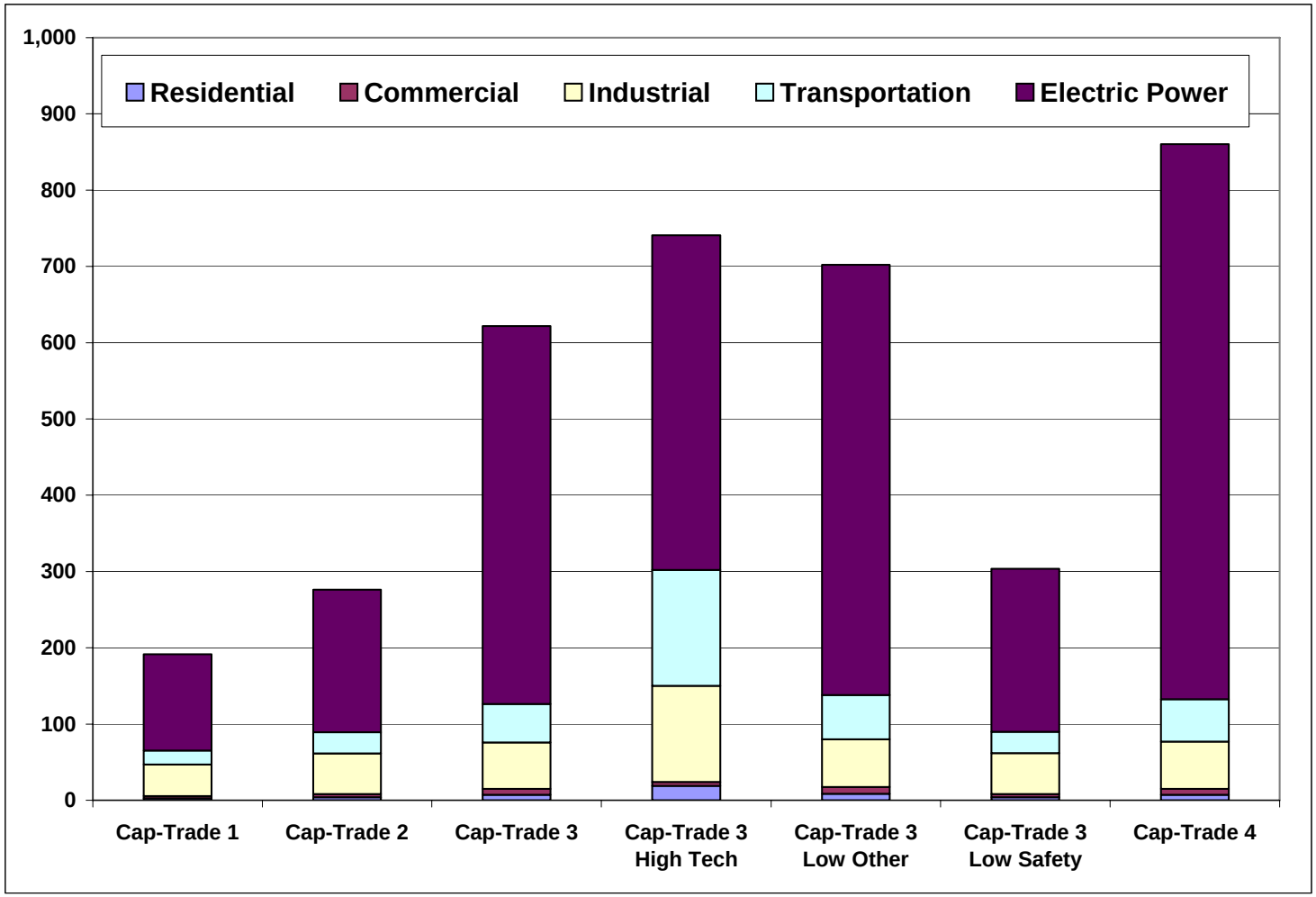
- The toughest program examined returns emissions to the 2004 level by 2030

GHG Emissions Reduction in 2020 in Alternative Cases (million metric tons CO_2 equivalent)



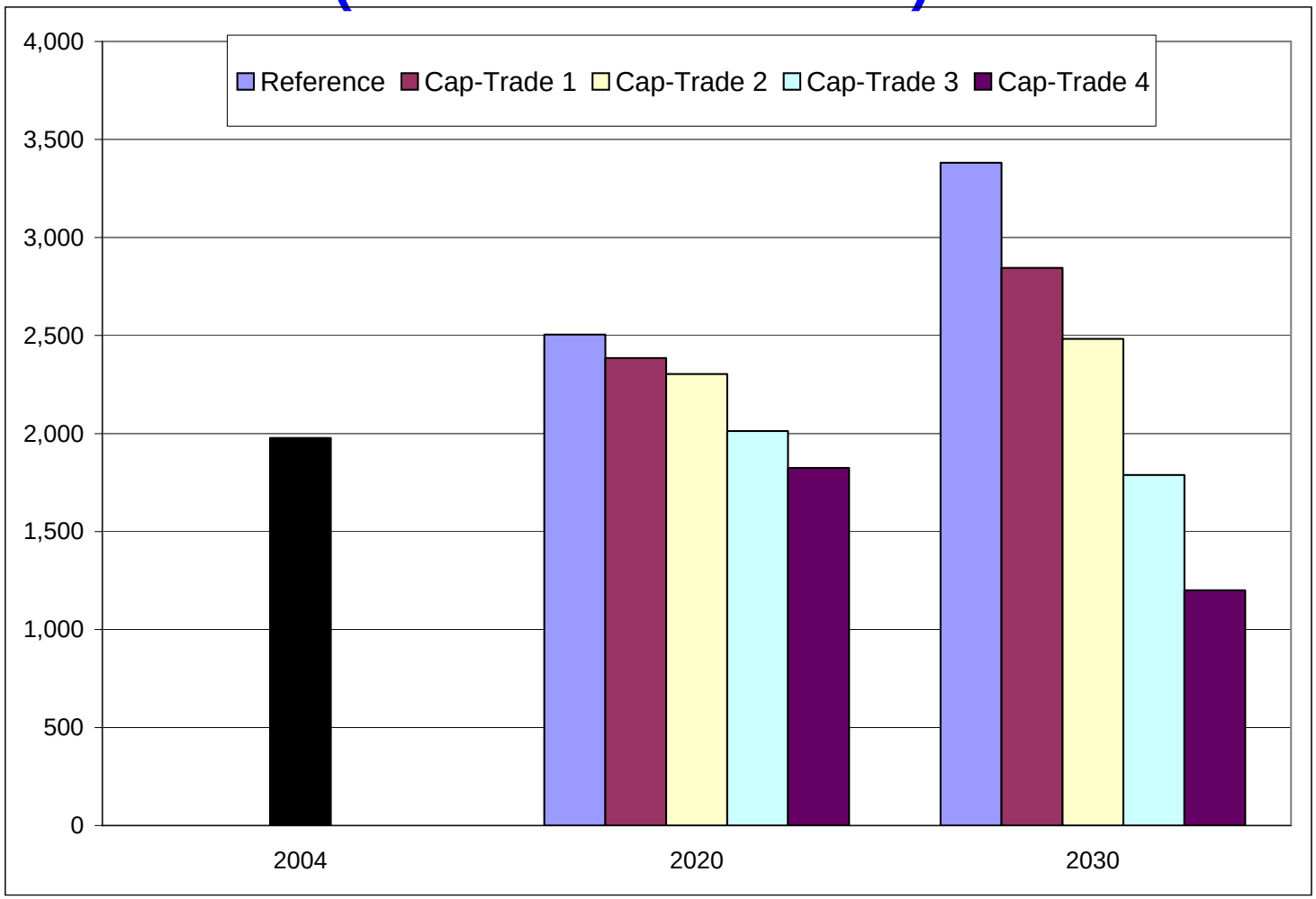
- EPA sees significant opportunity for low-cost reduction of non-energy GHGs

Energy-Related CO_2 Emissions Reductions in 2020 (million metric tons CO_2)



- The electricity sector is the main source of energy-related GHG reductions

Coal Generation in Alternative Cases
(billion kilowatthours)



- As the emissions cap is lowered, coal-fired generation is reduced

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